

Input namelist

The *focus* namelist is the only input namelist needed for FOCUS running. It should be written from the file *example.input*. Here are the details for the variables.

- **IsQuiet = -1**
Information displayed to the user
 -2: more details & update unconstrained cost functions;
 -1: more details;
 0: essential;
 1: concise.
- **IsSymmetric = 0**
Enforce stellarator symmetry or not
 0: no stellarator symmetry enforced;
 1: plasma periodicity enforced;
 2: coil and plasma periodicity enforced.
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- **case_surface = 0**
Specify the input plasma boundary format
 0: general VMEC-like format (Rbc, Rbs, Zbc, Zbs), seen in [rdsurf](#);
 1: read axis for knots, seen in [rdknot](#); (not ready)
- **knotsurf = 0.2**
Minor plasma radius for knototrans, only valid for case_surface = 1
- **ellipticity = 0.0**
Ellipticity of plasma for knototrans, only valid for case_surface = 1
- **Nteta = 64**
Poloidal resolution for discretizing the plasma
- **Nzeta = 64**
Toroidal resolution for discretizing the plasma
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- **case_init = 0**
Specify the initializing method for coils, seen in [rdcoils](#)
 -1: read the standard *coils.example* file;
 0: read FOCUS format data in *example.focus*;
 1: toroidally spaced **Ncoils** circular coils with radius of **init_radius**;
- **case_coils = 1**
Specify representation used for the initial coils, seen in [rdcoils](#)
 0: using piecewise linear representation; (not ready)
 1: using Fourier series representation;
- **Ncoils = 0**
Number of coils initilized, only valid for case_init = 1
- **init_current = 1.0E6**
Initial coil current (A), only valid for case_init = 1
- **init_radius = 1.0**
Initial coil radius (m), only valid for case_init = 1
- **IsVaryCurrent = 1**
Keep coil currents fixed or not, overridden by example.focus
 0: coil currents are fixed;
 1: coil currents are free;
- **IsVaryGeometry = 1**
Keep coil geometries fixed or not, overridden by example.focus
 0: coil geometries are fixed;
 1: coil geometries are free;

- **NFcoil = 4**
Number of Fourier coefficients for coils, only valid for **case.coils = 1**, overridden by **example.focus**
- **Nseg = 128**
Number of segments for discretizing coils, only valid for **case.coils = 1**, overridden by **example.focus**
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- **IsNormalize = 1**
Normalizing coil parameters or not
0: keep raw data (normalized to 1.0);
1: currents being normalized to averaged absolute current, coil geometry parameters being normalized to major radius;
- **IsNormWeight = 1**
each constraints normalized to initial value or not
0: keep raw value for constraints;
1: $w = w/f_0$ weights normalized to the initial values of each constraints;
- **case.bnrmal = 0**
 B_n error normalized to $|B|$ or not
0: keep raw B_n error;
1: B_n residue normalized to local $|B|$;
- **case.length = 0**
options for constructing coil length constraint, seen in [length](#)
1: quadratic format, converging the target_length;
2: exponential format, as short as possible;
- **weight.bnrm = 1.0**
weight for B_n error, if zero, turned off; seen in [bnrmal](#)
- **weight.bharm = 0.0**
weight for B_n Fourier harmonics error, if zero, turned off; seen in [bmnharm](#)
- **weight.tflux = 0.0**
weight for toroidal flux error, if zero, turned off; seen in [torflux](#)
- **target.tflux = 0.0**
target value for the toroidal flux, if zero, automatically set to initial Ψ_{ave} ; seen in [solvers](#)
- **weight.ttlen = 0.0**
weight for coils length error, if zero, turned off; seen in [length](#)
- **target.length = 0.0**
target value (or for normalization) of the coils length, if zero, automatically set to initial actual length; seen in [rdcoils](#)
- **weight.specw = 0.0**
weight for spectral condensation error, if zero, turned off; seen in [specwid](#); (not ready)
- **weight.ccsep = 0.0**
weight for coil-coil separation constraint, if zero, turned off; seen in [coilsep](#); (not ready)
- **weight.lnorm = 1.0**
additional factor for normalizing currents; the larger, the more optimized for currents; seen in [rdcoils](#)
- **weight.gnorm = 1.0**
additional factor for normalizing geometric variables; the larger, the more optimized for coil shapes; seen in [rdcoils](#)
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- **case.optimize = 1**
specify optimizing options.
-2: check the 2nd derivatives; seen in [infcheck](#); (not ready)
-1: check the 1st derivatives; seen in [infcheck](#);
0: no optimizations performed;
1: optimizing with algorithms using the gradient (DF and/or CG); seen in [solvers](#);
2: optimizing with algorithms using the Hessian (HT and/or NT); seen in [solvers](#); (not ready)
- **exit_tol = 1.000D-04**
additional criteria to judge if the cost function decreases significantly; if $\frac{|x_i^2 - x_{i-5}^2|}{x_i^2} < exit_tol$, send an exit signal; seen in [solvers](#)
- **DF_maxiter = 0**
maximum iterations allowed for using Differential Flow (DF); if zero, turned off; seen in [descent](#)
- **DF_xtol = 1.000D-08**
relative error for ODE solver; seen in [descent](#)
- **DF_tausta = 0.000D+00**
starting value of τ ; usually 0.0 is a good idea; seen in [descent](#)

- **DF_tauend = 0.000D+00**
ending value of τ ; the larger value of $\tau_{end} - \tau_{sta}$, the more optimized; seen in [descent](#)
 - **CG_maxiter = 0**
maximum iterations allowed for using Conjugate Gradient (CG); if zero, turned off; seen in [congrad](#)
 - **CG_xtol = 1.000D-08**
the stopping criteria of finding minimum; if $|d\chi^2/d\mathbf{X}| < CG_xtol$, exit the optimization; seen in [congrad](#);
 - **CG_wolfe_c1 = 1.000D-04**
 $c1$ value in the strong wolfe condition for line search; usually 1.0×10^{-4} ; seen in [congrad](#);
 - **CG_wolfe_c2 = 0.1**
 $c2$ value in the strong wolfe condition for line search; if one CG step takes too long, try to increase $c2$, but remember $0 < c1 < c2 < 1$; seen in [congrad](#);
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- **case_postproc = 1**
specify post-processing options.
0: no extra post-processing;
1: evaluate the present coils for each cost functions, coil curvature, coil-coil separation, and coil-plasma separation;
2: write mgrid file; (not ready)
 - **save_freq = 1**
frequency for writing output files; should be positive; seen in [solvers](#);
 - **save_coils = 0**
flag for indicating whether write example.focus and example.coils; seen in [saving](#);
 - **save_harmonics = 0**
flag for indicating whether write example.harmonics; seen in [saving](#);
 - **save_filaments = 0**
flag for indicating whether write .example.filaments.xxxxxx; seen in [saving](#);